Jordan River TMDL
A Phased Approach to Getting at the Source

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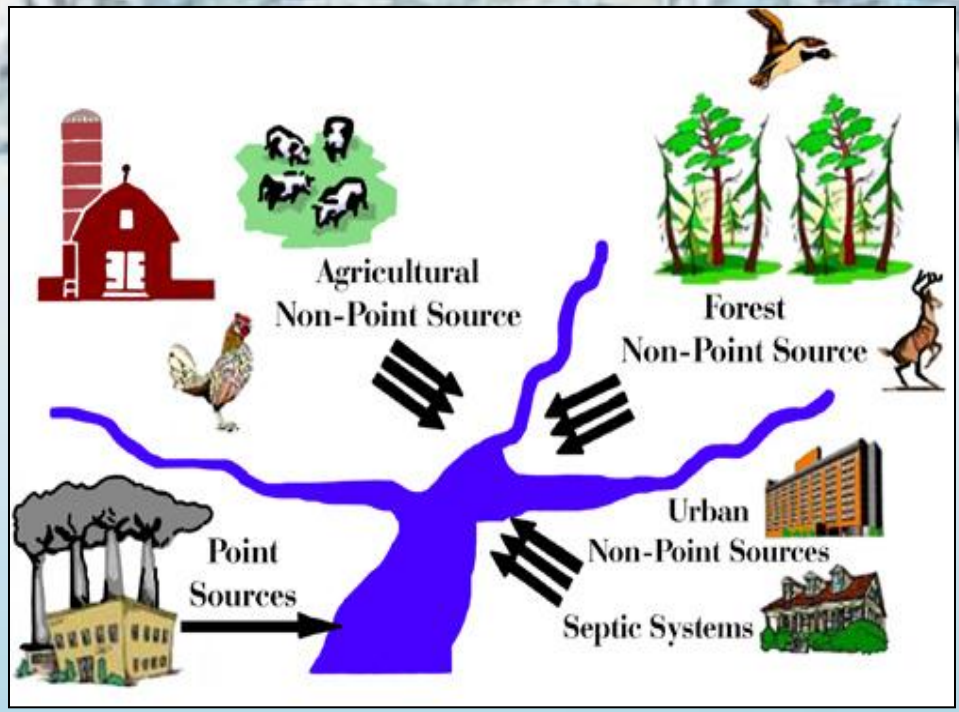
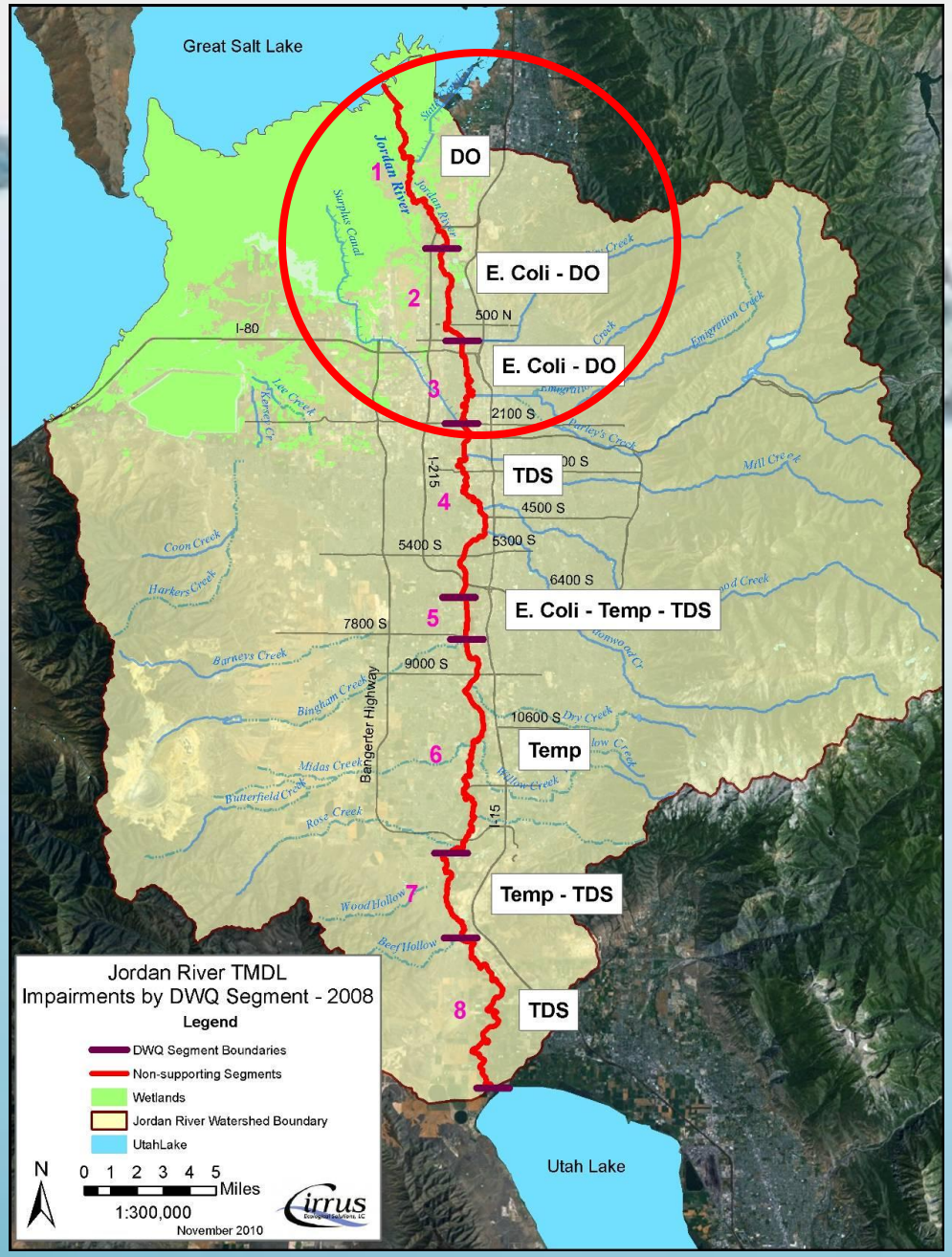
Outline of Presentation

- Background on TMDLs
- Jordan River Impaired Segments
- OM is Cause of Jordan River DO Impairment
- Phased TMDL Right for Jordan River
- Organic Matter Details and Model
- Phase 1 TMDL
- Next Phases
- Summary

What is a “TMDL”?

- Establishes “Maximum Daily Load” of pollutant to meet WQ standards
- Required for 303(d) list of impaired water bodies
- Must identify natural and anthropogenic sources of pollution
  - Point sources vs. Nonpoint sources
  - Margin of Safety (MOS) to address uncertainty





Jordan River Segments and Impairments

- **Beneficial Uses**
  - Class 2B-Recreation
    - All segments
  - Class 3A (Cold Water Aquatic)
    - Segment 4-7
  - Class 3B (Warm Water Aquatic)
    - Segment 1-4, 8
  - Class 4 (Agriculture)
    - All segments
- **Impairments**
  - Dissolved Oxygen
  - Total Dissolved Solids
  - Total Suspended Solids
  - Temperature (high)
  - *Escherichia coli*

What causes DO impairment?

- **Processes**
  1. **Physical limitations: temperature, solubility, reaeration**
  2. **Algal growth and respiration**
  3. **Decomposition in water column (BOD)**
  4. **Decomposition in sediments (SOD)**

- **Jordan River TMDL Assessment Method**
  - Data collection and review (1995-2008)
  - Synoptic and diurnal monitoring
  - Water quality models (QUAL2Kw)

- **Results**
  - Nutrient reduction has minimal effect on DO
  - Jordan River DO most responsive to organic matter
  - SOD highly significant
  - DO standards can be met by reducing OM concentrations year round

Phased TMDLs

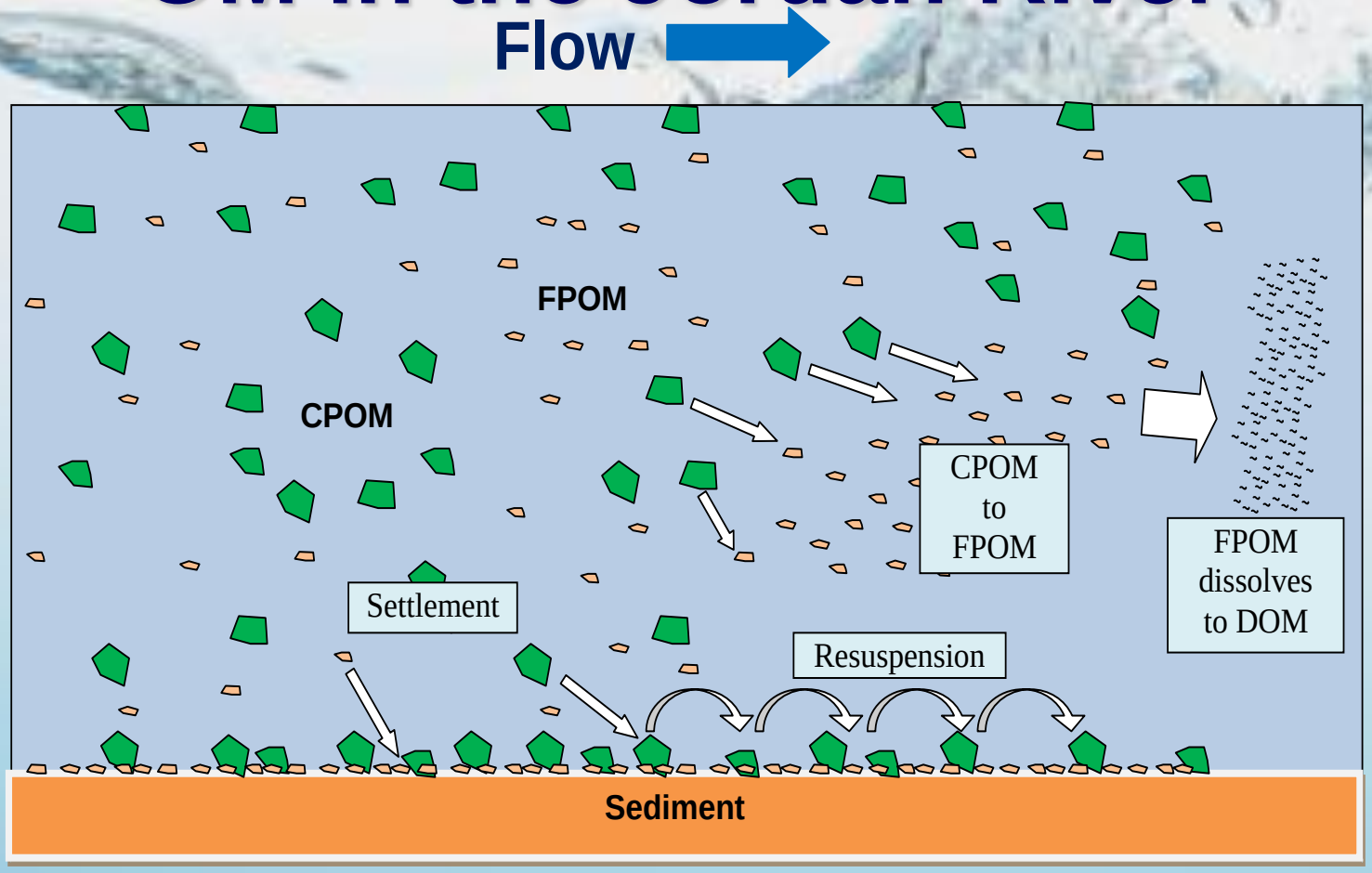
- **Must know:**
  - **Pollutant causing impairment**
  - **Amount of pollutant reduction to remove impairment**
- **Allows uncertainty:**
  - **Sources**
  - **Timing and fate of pollutants**
- **Going forward:**
  - **Schedule for refining wasteload and load allocations**
  - **Collection of additional data**
  - **TMDL revised with more specific implementation actions**

Why is it Right for the Jordan River?

- **Not enough certainty at this time to justify significant capital investments**
- **Uncertainties:**
  - **Characteristics of OM (sources, composition, transport, fate, and seasonal patterns)**
  - **Effectiveness of strategies to reduce OM**
  - **Effect of reducing suspended OM loads on DO without first removing the OM that already exists in the sediments**
  - **Loading from individual sources**
  - **Ecological effects**
- **Phased approach provides for additional studies**

Phased approach to implementing this TMDL is appropriate

OM in the Jordan River



Point sources: Stormwater, Wastewater Treatment Plants

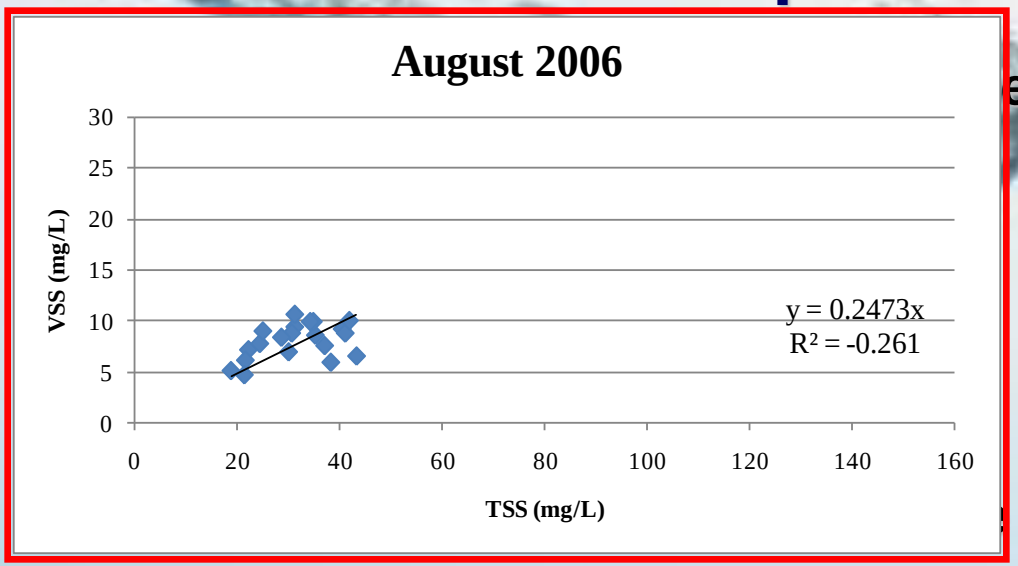
Nonpoint Sources: Diffuse Runoff, Irrigation Return, Natural Background, Tributaries, Utah Lake.

Model Response to OM Reductions
(August 2009)

No reduction of OM from Utah Lake				
Percent Existing	VSS - 2100 S (mg/L)	Avg SOD - lower Jordan River (gO2/m2/d)	Min DO (mg/L)	
			Cudahy	Burnham
100%	5.7	3.4	5.2	4.8
90%	5.3	3.0	5.4	5.0
80%	4.9	2.7	5.6	5.3
70%	4.5	2.4	5.8	5.5
60%	4.1	2.0	6.0	5.7
50%	3.7	1.7	6.2	6.0
40%	3.3	1.3	6.4	6.2
30%	2.9	1.0	6.6	6.4
20%	2.5	0.7	6.7	6.7
10%	2.1	0.3	6.9	6.9
Response with EQUAL reduction to Utah Lake				
70%	4.3	2.4	5.8	5.5

Methods to Measure OM

Volatile Suspended Solids (VSS)



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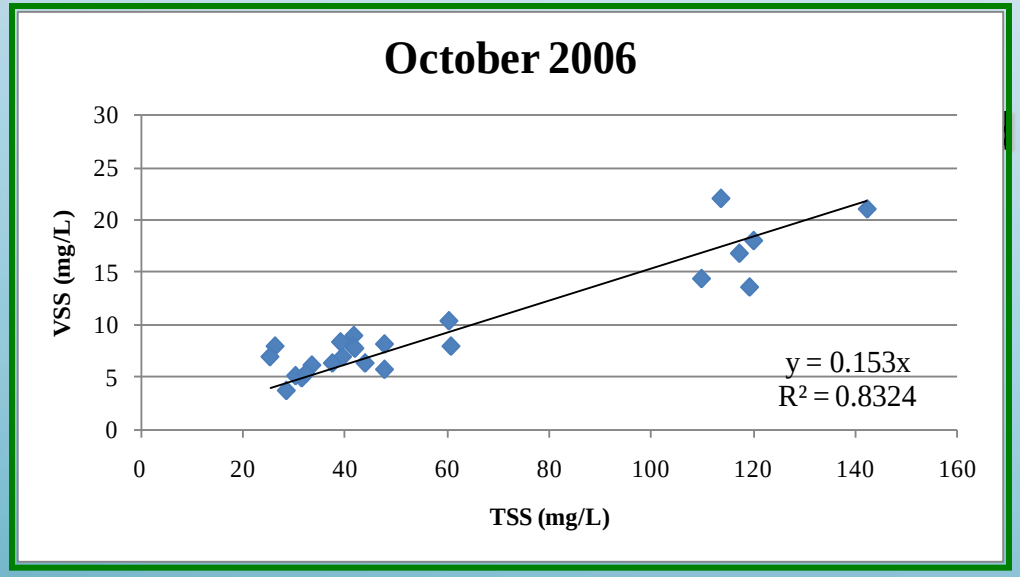

to extend OM data record

Methods to Measure OM

Biochemical Oxygen Demand (BOD)

- Oxygen consumed during aerobic decomposition
- Widely used surrogate to indicate OM content in water
  - Does not account for OM in sediment
- OM:BOD Relationship defined by OM:Carbon:Oxygen ratios
  - Quantifies Oxygen lost to decomposition process

Calculating Total OM Pollutant Loads

Total OM = FPOM + Other OM

- **FPOM ~ Volatile Suspended Solids(VSS)**
  - **Measured directly during 5 synoptic events**
- **Pollutant loads at source based on :**
  - **FPOM loads at source determined from data that correlates with FPOM including TSS or BOD**
  - **Source loads are then transported downstream to 2100 South after accounting for losses based on travel time, rates of settling and dissolution, and diversions**

Calculating Total OM Pollutant Loads

Total OM = FPOM + Other OM

- **Other OM ~ represented by prescribed SOD in QUAL2kW model.**
- **Prescribed rate suggests accumulation over long periods of time.**
- **Standard protocol to measure CPOM does not exist.**
- **Prescribed rate (g $O_2/m^2/d$) converted to equivalent OM daily load.**
- **Other OM loads allocated between sources based on annual flow contributions.**

Total OM loads to the lower Jordan River (kg/yr)

Sources		Current Loads at the Source	Current Loads to Lower Jordan River
Point Sources	Upstream of 2100 South	2,757,817	469,062
	Downstream of 2100 South	824,264	824,264
Nonpoint Sources	Upstream of 2100 South	6,941,909	752,429
	Downstream of 2100 South	303,749	303,749
Total		**10,827,739**	**2,349,504**

Jordan River TMDL

Bulk Allocation Existing OM loads (kg/yr) Lower Jordan River					
Source		**Loads to Lower Jordan**	**Contribution (%)**	**Permissible Loads**	**Reduction (%)**
Point Sources	Upstream of 2100 South	469,062	20%	284,996	39%
	Downstream of 2100 South	824,264	35%	482,096	42%
Nonpoint Sources	Upstream of 2100 South	752,429	32%	546,205	27%
	Downstream of 2100 South	303,749	13%	140,439	54%
Total		**2,349,504**	**100%**	**1,453,736**	**38%**

Phased TMDL

Adaptive Implementation Plan Timeline

Phase II (2011–2018):

- Continued monitoring: DO, stormwater
- Organic matter budget: When, where, how affect DO
- Outreach and education
- Reasonably affordable strategies to reduce OM loads
- Refine source loads and MOS for Total OM
- Submit revised TMDL for EPA approval in April 2018

Phase III (2018–2023)

- Adopt revised TMDL
- Design work on point and nonpoint sources to meet allocations
- Design and implement BMPs for stormwater

Phase IV (2023–2028)

- Construction upgrades for point sources and nonpoint sources
- Meet all DO water quality standards.

Summary

- **Phase I: Identification of OM as the pollutant**
  - **Development of models to calculate loading**
- **Phase II: Intense and targeted data collection**
  - **Implementation of behavioral and procedural changes for citizens and facilities**
- **Phase III: Final design**
- **Phase IV: Construction, if necessary**

Both point and nonpoint sources will bear responsibility to reduce OM loads to achieve the DO standards

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Thank you!

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Jordan River TMDL

Thank you for your interest in the Jordan River TMDL process. This webpage is designed to keep the Salt Lake Valley community better informed about what is going on with the Jordan River. Please refer back frequently, as we will continue to keep this page updated with the most recent information.

- Documents
- Linkage Symposium
- Technical Advisory Committee
- Jordan River Watershed Council
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http://www.waterquality.utah.gov/TMDL/Jordan_TMDL.htm

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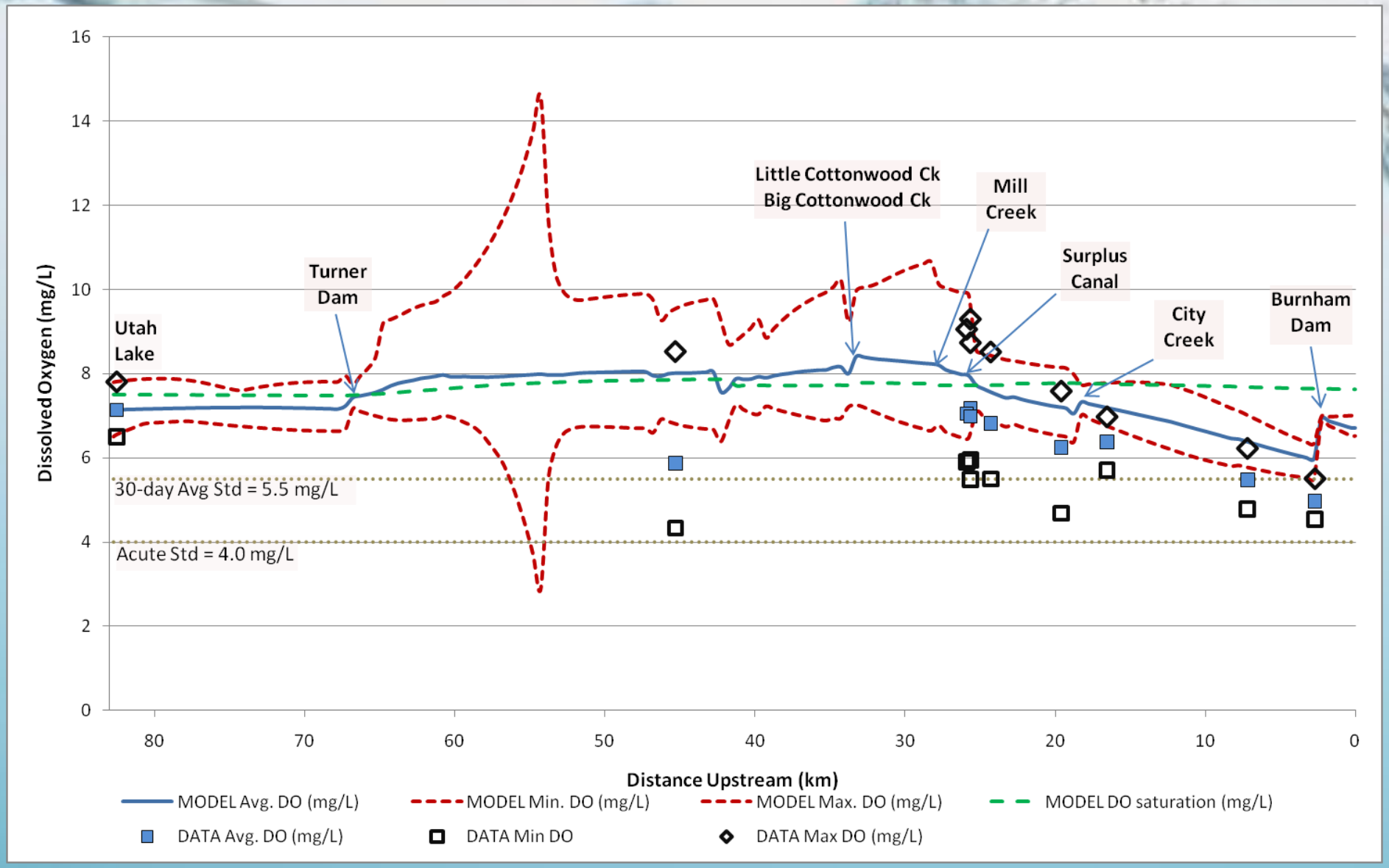
QUAL2Kw model results
(August 2009)



Margin of Safety (MOS)

Existing Loads into lower Jordan River (all implicit MOS scenarios)						
		469,062	824,264	752,429	303,749	2,349,504
Load Reduction into the Lower Jordan River with % total reduction						
Implicit MOS	0 mg/L ***(4.5 mg/L endpoint)***	106,498 (19%)	201,967 (37%)	131,078 (24%)	110,343 (20%)	549,887
Implicit MOS	1.0 mg/L ***(5.5 mg/L endpoint)***	184,066 (21%)	342,168 (38%)	206,224 (23%)	163,309 (18%)	895,767
Implicit MOS	1.5 mg/L ***(6.0 mg/L endpoint)***	243,946 (21%)	444,898 (39%)	254,999 (22%)	194,377 (17%)	1,138,220
Load Reduction Scenarios associated with a 0 mg/L implicit MOS.						
Explicit MOS	0%	106,498 (19%)	201,967 (37%)	131,078 (24%)	110,343 (20%)	549,887
Explicit MOS	5%	124,626 (19%)	233,082 (36%)	162,145 (25%)	120,014 (19%)	639,867
Explicit MOS	10%	142,754 (20%)	264,197 (36%)	193,213 (26%)	129,684 (18%)	729,848
Explicit MOS	15%	160,883 (20%)	295,312 (36%)	224,281 (27%)	139,354 (17%)	819,829
Explicit MOS	19%	176,182 (20%)	321,570 (36%)	250,499 (28%)	147,515 (16%)	895,767
Explicit MOS	33%	225,028 (20%)	405,409 (36%)	334,211 (29%)	173,572 (15%)	1,138,220

Permissible Loads into lower Jordan River						
Implicit MOS	0 mg/L	362,564	622,296	621,351	193,405	1,799,617
Implicit MOS	1.0 mg/L	284,996	482,096	546,205	140,439	1,453,736
Implicit MOS	1.5 mg/L	225,116	379,366	497,430	109,372	1,211,284

OM Results

OM loads contributing to SOD in the lower Jordan River (kg/yr)				
		Load at Source	Load to Lower Jordan River	Percent Contribution to Lower Jordan River
Point Sources	Above 2100 South	132,724	25,551	5.8%
	Below 2100 South	43,604	43,604	9.9%
Nonpoint Sources	Above 2100 South	2,094,670	274,933	62.4%
	Below 2100 South	96,884	96,884	22.0%
Total		2,367,882	441,022	100.0%

Upstream of 2100 S = 68%

Nonpoint = 85%